No. 9.— *The Collection of Amphibia Caudata of the Museum of Comparative Zoology.*

By Emmett R. Dunn.

This paper records some of the results of a recent study of the M. C. Z. collection of tailed amphibians. The localities, Museum catalogue number, and the number of specimens (in parentheses) are given under each form. The enumeration is complete to October, 1918. The collection contains 86 species or subspecies and 2,703 specimens. The records enclosed in square brackets have been supplied by Dr. Thomas Barbour.

Necturidae.

1. Necturus maculosus (Rafinesque).

Loc. ? 1,820; 4,709.— Lake Champlain, 276 (2); 1,061 (2); 1,844 (*skull*).— N. Y.: Cayuga Lake, 1,282; 1,861 (14); 2,010 (17); Ithaca, 1,371 (2); 1,713 (2); [Rochester, 313 (3)].— Ohio: Sandusky River, 1,849 (4).— Mich.: Antrim Co., Torch Lake, 2,447; 4,708; Northport, 4,271.

M. C. Z. 2,010 includes a series ranging from 83–320 mm. in length. The smaller ones, as well as 2,447 and 1,820 (53 mm. long) show a most distinct striping, in the form of a median and two lateral dark stripes. These persist in the adult in the dark line through the eye, but elsewhere on the body they disappear and are replaced by numerous spots.

2. Necturus punctatus (Gibbes).

S. C.: Santee River, 1,553 (cotype).

This specimen is 150 mm. long. It is slimmer than *N. maculosus* of equal length, and lacks all trace of stripes, even the black line through the eye. There are no spots.

I have examined about fifteen specimens of this form, from Wilmington, N. C., Ogden and Charleston, S. C., and the Little Pedee and Santee Rivers, S. C. They all agree in being perfectly uniform dark

above and uncolored on the belly. The Pedee River series ranges from 40–150 mm. in length and shows no color-pattern at any stage. There can be no question of the distinctness of this form.

3. Proteus anguinus Laurenti.

Loc.? 4,279; [4,312–4,314 (3)].— Europe, [873]; 4,269; 4,270.— Carniola, Caves, 3,973; Adelsburg cave, 2,366.— Dalmatia, 1,905.— Styria: Gratz, 1,942.

Unfortunately, some of these specimens cannot be referred to any of the various local races. They are all long snouted as figured by Boulenger for *P. carrarae* and for *P. zoisii*. M. C. Z. 1,942 is uniformly pigmented above; 3,973, and 4,269 are slightly striped.

Cryptobranchidae.

4. Cryptobranchus alleganiensis (Daudin).

Loc.? 1,320 (*skeleton*); 1,845 (*skull*); 4,372 (*slough*).— N. Y.: ? Cayuga Lake, 2,009 (5); Headwaters Allegheny River, 1,281 (3).— S. C.: Charleston, 256.— Missouri, 134 (4).

5. Megalobatrachus maximus (Schlegel).

Loc. ? 4,721.— Japan: 332; [1,887 (*skeleton*)]; Nagasaki, 2,393; Tokio, 1,896 (4).— China: Western Szechuan, Hung-ya-hsien, 2,849; Ya-chow, 2,853.

The two Chinese specimens are noteworthy as giving definite locality-records of this species on the mainland of Asia.

Amphiumidae.

6. Amphiuma means Garden.

S. C., 938.— Ga., 148.— Fla.: Eau Gallie, 2,768; Pensacola, 141; 150.— [Ala.: Mobile, 143].

All the above are small, nearly uniform blackish above and below, and with two fingers or toes on all the limbs.

7. Amphiuma tridactylum Cuvier.

Ala.: Greensboro, 4,079.— Miss.: Natchez, 144.— La.: 25 miles N. of New Orleans, 1,629–1,631 (3).

These are very large, dark above and light below with a distinct line of demarcation. There are three fingers or toes on all the limbs.

Salamandridae:

We are confronted with the problem of what name to apply to that mass of species of Salamandridae, which is often called Triton Laurenti (1768), not Linné. The earliest substitute name, as Stejneger has shown, is Triturus Rafinesque 1815. If, however, we subdivide Triton Laurenti, we must ascertain the type, and to it and its allies restrict the generic name Triturus. Fitzinger indicated *T. cristatus* Laurenti as type of Triton in 1843.

This aggregate of species is usually separated on the presence or absence of a bony postfronto-squamosal arch. Nevertheless European herpetologists, while retaining the genus in its all-embracing entirety, usually recognize certain groups of vicarious species, such as the Euproctus group, the Pleurodeles group, etc.

The species of these groups which are in many instances scarcely more than local races are not marked by constancy in the supposedly important character of the postfronto-squamosal arch. When it is found that in the Euproctus group, *asper* of the Pyrenees and *rusconii* of Sardinia have the bony arch, and that *montanus* of Corsica lacks it, suspicion arises that this character *surely* has been given a fictitious value. Similarly, such closely allied animals as *vulgaris*, *palmatus*, *montandonii*, *boscai*, and *italicus*, which are not at all easy to distinguish out of the breeding dress, and which are, as Wolterstoff states, in large part vicarious forms, are characterized by no such uniformity in the temporal arch as we should expect if this character is of great importance. Two, *vulgaris* and *italicus*, lack it, the rest have it. It seems that no weight can be placed on a character which separates closely allied forms and throws together forms not at all closely related. All the newts seem to be developing or losing this arch more or less independently.

If we remove the Euproctus group and the Pleurodeles group the most distinct species is unquestionably Cope's *crocatus* from Persia.

This animal is in appearance far more like Salamandra than like Triturus, as it has a long rounded tail, and is marked with large yellow spots. The dentition, however, is that of Triturus. Perhaps this animal had better remain as Cope described it, the type of Neurergus. Here also may belong *Molge macroscma* Boulenger, whose habitat is unknown.

A very natural group is formed by *vulgaris*, *palmatus*, *italicus*, *montandonii*, *boscai*, *vittatus* of Gray, and the North American forms allied to *viridescens*. These are all similar in size, coloration, shape of head, and even agree in the possession of three longitudinal grooves on the head. I do not see how these animals can be divided into two genera. It may here be noted that in this group are two forms known as *vittatus* and two known as *meridionalis*.

This necessitates a renaming of two forms, a course as regrettable as it is necessary.

The other species, including the European *cristatus*, *marmoratus*, and *alpestris*, the Asiatic *wolterstoffi*, *sinensis*, *pyrrhogaster*, and *ensicaudus*, and the American *torosus* are more or less problematical in their relationships; the last, *torosus*, seems closer to the Asiatics than to the Europeans, just as *viridescens* is far closer to the Europeans of the *vulgaris* group than to *torosus*.

If the possession of a dorsal crest by the breeding males and the lack of a bony temporal arch are considered primitive characters, it is quite apparent that these two characters are practically restricted to Europe, where the Salamandridae reach their greatest development in number of forms, and which is the geometrical centre of the family's range (especially if we consider *viridescens* as derived from Europe and *torosus* from Asia).

In this case certainly one does not find the primitive forms on the periphery of the range. On the other hand, if the bony arch is regarded as primitive and the dorsal crest of the breeding male as specialized, we find the primitive forms on the periphery of the range. But if we regard the bony arch as primitive, then all the other salamanders have lost it.

There are certainly strong reasons why the presence of the post-fronto-squamosal arch should be considered primitive. In the first place the idea is quite erroneous that the more larval a salamander, the more primitive it is. Early amphibians as well as the Crossopterygian ganoids from which they were almost certainly derived had a practically complete bony temporal roof. This roof was present in the Cotylosaur reptiles and persists in its most complete modern state

in the sea-turtles. One constantly finds references to the skull of such an animal as Necturus as being very "low," meaning apparently primitive. Actually, of course. the skull is simple compared to higher types, but this is not by any means the same thing as primitive, for primitive amphibians had a skull far more complex than any animal now living. We seek in vain in Necturus for lachrymals, dermosupra-occipitals, tabularia, supratemporals, intertemporals, jugals, quadrato-jugals and others "too numerous to mention." But all these bones were possessed by the primitive amphibians. In the same way the fact that Cryptobranchus has larval gill-arches is no indication of its primitive character. It is merely a case of arrested development.

The case for the primitiveness of Necturus rests on its separate opisthotic (paroccipital) and on the character of the pubis. The case for the Cryptobranchidae is chiefly the separate prearticulars, the large size, and the fact that a fossil is known. Even the branchials, larval as they are, differ from normal larval branchials in the absence of an epibranchial.

At any rate the primitive amphibian skull is not a simple one and a temporal roof, or the remains of a temporal roof, should be a character of the most primitive living salamanders.

In opposition to this view may be placed the two characters of Necturus just alluded to, but the pelvis of Necturus is so different from that of the Mutabilia that there may be little real affinity, and the paroccipital may yet be found to occur in the development of more than one larval salamander.

A greater difficulty in the way of this view is the fact that in other characters the newt skull is not as primitive as several which lack any trace of the arch. For instance, Ranodon, with separate lachrymals and prefrontals, and Salamandra with two premaxillaries. The fact that the premaxillaries of the salamanders with the temporal arch are fused is perhaps the greatest obstacle to their being regarded as primitive, for there is no disputing the fact that to have the premaxillaries separate is more primitive than to have them fused. But separate premaxillaries are sometimes found, as in Geotriton, along with such specialized characters as the complete absence of the lachrymo-prefrontal bone.

The newt vertebrae are opisthocoelous and the carpus and tarsus are ossified, but it is probable that the cartilaginous carpus and tarsus of many of the modern salamanders is due to arrested development and there are forms known from the European Miocene which have the opisthocoelous vertebrae.

In view of the far too great emphasis that has been laid on the developmental stage reached by individual species in assigning them to a place in the system, and also of the far too common practice of regarding characters of arrested development or aquatic adaptation as primitive, it is perhaps not out of place to emphasize a somewhat different view.

8. Tylototriton verrucosus Anderson.

British Sikkim: Darjiling, 3,569.

9. Tylototriton andersoni Boulenger.

Liu Kiu: Okinawa, Nago, 2,579 (2).

These are the third and fourth specimens of this species on record.

10. Pleurodeles waltl Michahelles.

Spain: Albacete, 1,935 (2).

11. Salamandrina terdigitata (Bonnaterre).

Italy: Genoa, 1,625 (3); 1,943 (3).

12. Euproctus poireti (Gervais).

Algeria, 1,043.

13. Euproctus rusconii Gené.

Sardinia, 2,167 (2).

14. Triturus torosus (Eschscholtz).

Cal., 179 (3); 243 (13); 1,205 (2); 1,206 (5); 1,825; 1,830 (2); 4,603; 4,604; Berkeley, 4,325–4,328 (72 *larvae*); Brookdale, 3,144; Navarro River, 2,354 (7); Palo Alto, 2,352 (7); 2,353 (9); 2,355 (5); 2,530 (7); San Francisco, 173; 260 (4); 3,699; San Mateo, 1,207 (16); 4,319–4,324 (6); San Quentin, 1843 (5); Sierra Madre Mountains, 3,151–3,154 (4); Stanford University, 3,145; 3,146; Ukiah, 2,349; Upper Cal.: Cache River, 259.

15. Triturus ensicaudus (Hallowell).

Lui Kiu: Okinawa, 2,585; Okinawa, Nago, 2,593 (4).

16. TRITURUS PYRRHOGASTER (Boie).

JAPAN, 1,230 (3); 4,688; Kanagawa, 1,607 (3); 1,915 (24); Mt. Fuji, 2,587 (5); Tokio,1,865 (3).

17. TRITURUS WOLTERSTORFFI (Boulenger).

CHINA: Yunnan-fu, 2,556 (3).

18. TRITURUS MONTANDONI (Boulenger).

RUMANIA: Carpathian Mountains, Sinaia, 3,570; 3,571.

19. TRITURUS BOSCAI (Lataste).

SPAIN: Coruña, 1,997 (10); Galicia, 1,622 (5).— PORTUGAL, 1,895.

20. TRITURUS VIRIDESCENS Rafinesque.

Loc. ? 4,712–4,720 (9).— NOVA SCOTIA: Yarmouth County, 2,292.— ME.: Norway, 1,126 (2).— N. H.: Amherst, 1,131; 1,149 (10); Exeter, 1,120 (5); Jaffrey, 4,679–4,685 (7); West Campton, 1,124.— VT.: Burlington, 1,150 (89); 1,419 (3); 1,432 (8); 4,678; Windsor, 203 (5).— MASS.: Arlington, 2,308 (3); Bedford, 1,132 (4); Berlin, 1,130; Cambridge, 1,144; Chicopee, 1,118 (2); 1,142 (6); 1,143 (3); Franklin County, 2,080 (15); Gloucester, 1,385; Lancaster, 171 (2); Leyden, 1,146 (9); 4,317; 4,318; Medford, 1,123 (2); Newton, 1,911 (3); 1,912 (8 *larvae*); Pittsfield, 2,290 (8); Rowe, 172 (75); 186 (11); Salem, 1,155 (3); Sherborn, 1,137; 2,005 (2); Springfield, 1,990; 2,008 (2); 2,069 (13); 4,614–4,617 (4); 4,754 (2); Wachusett, 2,268; Ware, 1,136 (27); Williamstown, 180 (5); 1,135 (5); 1,147 (20); 1,831 (2); Worthington, 1,139 (6); 1,151 (19).— N. Y., 194 (28); Berkshire, 177; 207 (2); Brooklyn, 230; Crown Point, 1,140; 1,237 (*larva*); 4,731; 4,732; Fallsburg, 4,315; 4,316; Rome, 184 (19); Saratoga, 2,105; Sodus, 1,153 (11); Somerville, 167; 189 (2); Sullivan County, 1,141 (24); 1,145 (2).— N. J.: Plainfield, 2,303; Ridgewood, 2,411; Schooleys Mountain, 160.— PA.: Center County, 1,127 (3); Monroe County, 1,125 (5).— VA.: Fredericksburg, 2,079; Monterey, 1,121.— W. VA., 1,148 (3); White Sulphur Springs, 1,418.— OHIO: Windham, 2,000 (5).— IND.: New Albany, 2,078 (2); New Harmony, 214 (2).— ILL.: Normal, 2,055.— KY.: Cumberland Gap, 2,224 (2); Letcher County, 1,707; Mammoth Cave, 1,048 (4).— TENN.: Knoxville, 1,128.— N. C.: Glade Creek, 1,134.— S. C.: Charleston, 1,122 (3).— GA., 1,133.— FLA.: Amelia Island, 1,129; Jacksonville, 4,697.— TEX.: Dallas, 4,618–4,625 (8).— ?ARIZ., 1, 836 (2).

21. Triturus dorsalis (Harlan).

N. C.: Wilmington, 1,992 (2, paratypes of *T. vittatus* (Garman).— Fla.: Jacksonville, 1,439 (9).

This form appears to coexist along the coast with *T. viridescens* and until better known may be regarded as distinct. It is unquestionably congeneric with *Triton vittatus* Gray, described from England, but recorded also from France, the Carpathians, and Syria. Both have the bony temporal arch. Therefore Garman's name *Diemyctylus viridescens vittatus* (1897) yields to that of Gray, (1835) and a new name would be necessary were it not that Harlan (Journ. Acad. nat. sci. Phila., 6, p. 101) described this animal as *Salamandra dorsalis* from South Carolina (probably Charleston).

22. Triturus meridionalis (Cope).

La.: Allemia, 4,263–4,266 (4).— Tex.: Dallas, 1,152; 4,626–4,649 (29).

This also seems distinct, although both this and *T. dorsalis* are very close to *T. viridescens*. There is an excellent opportunity for good work on the relationships of these three Southern forms with each other, oecologically as well as morphologically.

23. Triturus helveticus (Razoum).

Loc. ? 1,232 (23); 4,335–4,344 (10 larvae).— France: Paris, 1,612 (20).— Switzerland, 4,710; Neuchâtel, Montagny, 4,711.— Austria: Vienna, 443.— Baden: Freiburg, 4,329–4,332 (4).

24. Triturus vulgaris (Linné).

Loc.? 1,233 (3); 4,333; 4,334.— England, 1,227 (25); 4,674–4,677 (4); Manchester, 1,228; 4,699; 4,700.— France: Paris, 1,623 (5).— Germany, 1,226; 4,669–4,673 (5); 4,724.— Silesia, 2,791 (3); Fulengebirge, 3,312–3,320 (9).— Russia: Sukhun Kale, 1,963 (2).

25. Triturus vulgaris boulengeri, nom. nov.

Italy: Piedmont, 1,361 (8).

Boulenger's *meridionalis* was published in 1882, two years after Cope's *meridionalis*. If the two species are congeneric, as I believe they are, a substitute must be employed for *meridionalis* Boulenger.

26. Triturus alpestris (Laurenti).

Loc. ? 1,224; 4,704; 4,705.— Alps, 1,223 (3); 1,396 (4).— Switzerland, 1,221; 4,706; Lake Neuchâtel, Montagny, 923; 4,707.— Italy: Milan, 1,036.— Austria, 1,222.— Silesia, 2,798 (10); Fulengebirge, 3,321–3,325 (5).— Prussia: Berlin, 2,089.— Germany, 1,225 (3).

27. Triturus marmoratus (Latreille).

France, 1,229 (2); Cadillac, 2,323 (15); Gironde, 1,624 (2).— Spain: Coruña, 1,998 (2).

28. Triturus cristatus (Laurenti).

Loc. ? [4,283].— Europe, 1,218 (6).— Great Britain, 1,220.— England, 1,339; Liverpool, 1,219 (8); 4,698; Northamptonshire, 1,433.— France: Paris, 1,626 (18).— Germany, 1,217 (2).— Wurtemberg: Esslingen, 2,099.— Bavaria, 2,077 (4).— Silesia, 2,801 (4); 3,303–3,311 (9).— Hungary: Budapest, 1,292 (2); 1,293 (3).— Russia: Sukhum Kale, 1,962.

29. Triturus cristatus platycauda (Rusconi).

Italy: Milan, 1,035 (3); Piedmont, 1,360 (5).

This name of Rusconi's (1821) has many years of precedence over Strauch's *karelinii* (1870).

30. Chioglossa lusitanica (Bocage).

Portugal: Serra da Estrella, 1,925.

31. Salamandra salamandra (Linné).

Europe, 4,280–4,282 (3).— England, 2,084 (2).— France, 1,212 (2).— Italy: Milan, 1,034 (3).— Germany, 896; 1,215 (12); [1,703 (2)]; 2,101 (4 *larvae*); [Darmstadt, 1,213 (2)]; Herkulesbad, 2,796 (2).— Wurtemberg, 1,214 (7).— Algeria: Algiers, Edough, 1,700 (2).

32. Salamandra atra Laurenti.

Europe, 1,216 (6); 1,949 (3 *larvae*).— Switzerland, 1,231 (3); [1,395 (3)].— Salzburg: Hohen Göll, 1,045 (3).— Silesia: Breslau, 2,075 (7).

AMBYSTOMIDAE.

33. SALAMANDRELLA KEYSERLINGII Dybowsky.

SIBERIA: Lake Baikal, 1,288 (2).

34. ONYCHODACTYLUS JAPONICUS (Houttuyn).

JAPAN: Hondo, Hakone Lake, 2,586 (4); 2,594 (5 *larvae*); 2,595 (9 *larvae*); Tokio, 1,864 (*larva*).

The vomerine teeth of the adults are in two arched series behind the choanae, the two arches extending forward to a line through the anterior edge of the choanae.

The Asiatic Ambystomidae fall into two groups whose vomerine dentition is rather distinct. On the one hand, those whose tooth-series extends farther back in the middle than on the sides; to this group belong Hynobius, Pachypalaminus, and Salamandrella. *Hynobius lichenatus*, however, is transitional to Onychodactylus in dentition.

The second group of those whose vomerine series does not extend farther back in the middle than on the sides includes Onychodactylus, Geomolge, Batrachyperus, Ranodon, and Ambystoma.

This backward extension of the vomerine teeth in the middle means of course a quite different shape of the vomero-palatine bone.

In Ambystoma the teeth form a nearly straight series, not widely separated in the middle. In Ranodon and Batrachyperus the series are widely interrupted, and they are very short.

In Onychodactylus and Geomolge the series form a double arch, convex forward, and not widely separated in the middle.

The tooth-row in Onychodactylus is usually described as continuous, but it is not. There are three described forms in this group.

The most recently named is *Onychodactylus russicus* Nikolsky (Ann. Mus. zool. Acad. sci. St. Petersburg, 1913, **18**, no. 2, p. 260).

Fortunately a Latin diagnosis is given with the Russian description. It states in brief:—like *japonicus* but the tail shorter than the head and body. The third digit of the foot is the longest. The fifth is slightly shorter than the third. The head-length enters the length from gular fold to anus 3–3½ times. There are fifteen costal folds. The appressed feet do not meet. The total length is given as 75 mm., the body as pallid above, varied with dark spots, beneath immaculate white.

The type-locality is "prope sinus Ussuriiensem Sibiriae."

Nikolsky's figure (Ann. Mus. zool. Acad. sci. St. Petersburg, 1896, **1**, p. 78 reproduced in Stejneger's Herpetology of Japan, p. 24) of the teeth of Onychodactylus, Salamandrella, and Geomolge, compared with Boulenger's Catalogue of Batrachia Gradientia, p. 35, makes it quite plain that Nikolsky has practically copied Boulenger's conventionalized figure, and this is an inaccurate representation of the dentition of *Onychodactylus japonicus*. The vomerine teeth of *O. japonicus* are in all respects like Nikolsky's diagram for *Geomolge fischeri*, and like Boulenger's figure of the same (Proc. Zool. soc. London, 1886, pl. 39, fig. 6). This plate, which is part of the original description, is reproduced as part of plate 5 in The herpetology of Japan. According to Stejneger, larvae, males, and breeding females of *O. japonicus* possess claws; and Thompson (Proc. Cal. acad. sci., ser. 4, **3**, p. 183–186) in his description of *Pachypalaminus boulengeri*, states that the young of Geomolge also possess stout claws.

The physiognomy of *Geomolge fischeri*, according to Boulenger, is "that of *Onychodactylus japonicus*. . . . Limbs in every respect similar to those of *Onychodactylus japonicus*, save the absence of claws; the male likewise with tibio-tarsal dilatation. . . . Anal opening subcruciform, as in *Onychodactylus*. Skin smooth; fourteen or fifteen costal grooves; paratoids and gular fold as in *Onychodactylus*. Brown above, with blackish variegations, most crowded on the sides, which also bear some whitish spots; lower surfaces brownish white." The measurements given for a male are total length 163 mm., head 12 mm., tail 93 mm. The female measured 80 mm. from snout to vent, head 14 mm., tail lacking, body 66 mm.

As the difference in dentition seems chiefly imaginary, and the possession of claws at some stage is common not only to these forms but also to others (Pachypalaminus) whose dentition is quite different, the genera cannot be maintained as distinct.

The differential characters of *O. russicus* are first of all the short tail. All long-tailed salamanders have short tails when they are young. The proportional head-length agrees with the figure of Stejneger for *O. japonicus*. The head is too long for Boulenger's measurements of *G. fischeri*; but *G. fischeri* has a longer body than *O. japonicus*.

Compare the following measurements with those given above:—
Male; total length 161 mm., tail 92 mm., head 16 mm., body 53 mm.
Female; " " 141 mm., " 72 mm., " 15 mm., " 54 mm.

Also the head in young salamanders is always proportionally longer than in the adult. The digits as given are quite similar to both *O. japonicus* and *G. fischeri*. Fourteen costal folds are given by Boulenger for *G. fischeri*.

Thus there is the well-known *Onychodactylus japonicus* from Japan; *O. fischeri* (Boulenger) based on two adults from the Ussuri district in Siberia; and a third, *O. russicus* Nikolsky, from the same region based on young specimens. Most of the differential characters which separate this third form are characters of young salamanders in general. In particular the claws which Nikolsky supposed to ally it with *O. japonicus*, are according to Thompson present in young *O. fischeri*. There is therefore a strong probability that *Onychodactylus russicus* Nikolsky is the young of *O. fischeri* (Boulenger).

35. Batrachyperus sinensis (Sauvage).

China: Szechuan, Liang-hoko, (12,000 ft.) 2,848.

36. Ranodon sibiricus Kessler.

Russia: Kopal, 1,964.

37. Ranodon olympicus Gaige.

Washington: Lake Cushman, 4,103 (paratype); Olympic Mountains, Mt. Rose, 4,272; 4,273.

38. Ambystoma opacum (Gravenhorst).

N. H., 958.— Mass., 4,352; Arlington, 2,295; Berlin, 960; Lynn, 1,690; 1,947; 2,443; Lynn Woods, 3,700; Salem, 1,416 (*larva*); Sudbury, 2,289; Waltham, 957.— N. Y., 220.— N. J.: Paterson, 2,395.— Ind.: New Albany, 2,074.— Mo.: New Madrid County, 3,143.— Ga., 157.— Ala.: Maplesville, 4,551.— La.: 25 miles N. of New Orleans, 1,633.— Texas, 202.

The larvae of the species of Ambystoma are much more difficult to determine than those of Eurycea (Spelerpes). However, I have identified by the use of certain undoubted specimens of larval *A. opacum*, *A. maculatum*, and *A. tigrinum*, the various larvae in the collection. The criteria used may be of interest, and in so far as they are found to be constant the records of larvae can be accepted.

A. opacum. The appressed legs scarcely meet. Stouter. Belly pigmented. Less definite demarcation between the color of back and belly. Light dots on side. Head large.

A. tigrinum. The legs scarcely meet, the belly is not pigmented. A line of light dots at demarcation between back and belly. Head large.

A. maculatum. Legs overlap, slimmer, belly not pigmented, more definite demarcation between back and belly, tail not blotched, head smaller, no stripes.

A. jeffersonianum. Legs overlap, slimmer, belly not pigmented, dark line at demarcation between back and belly, tail with black blotches above, white stripe on side above insertion of legs.

39. AMBYSTOMA MACULATUM (Shaw).

CANADA: St. Lawrence, 208.— NOVA SCOTIA, 942.— NEW ENGLAND, 1,867.— ME.: Norway, 945 (2); Upton, 948; Waterville, 2,017 (2).— N. H.: Amherst, 971; Chocorua, 2,763.— MASS., 153; 199; Amherst, 955; Auburndale, 219 (2); Berkshire County, 946; Brookline, 949; 1,991; Cambridge, 951; Lynn, [1,482]; 1,994 (5); Malden, 954 (2) Quincy, 4,345; Salem, 1,993; 2,018; Springfield, 2,070 (2); Waltham, 213 (2); Ware, 944.— N. Y.: Ithaca, 4,346–4,350 (5 *larvae*); Rome, 181 (2); Somerville, 168; 188 (2); Tupper Lake 1,238 (3 *larvae*).— N. J.: Campgaw, 4,260.— PA.: Sullivan County, 2,001 (2);— IND.: Bloomington, 2,071.— MICH.: Olivet, 4,351.— TENN.: Knoxville, 947.— S. C.: Charleston, 182.— LA.: New Orleans, 2,019; Port Hudson, 956.

40. AMBYSTOMA TIGRINUM (Green).

S. C.: Charleston, 245 (8 *adults* and *larvae*); 246 (6).— OHIO: Columbus, 963; 4,357–4,359 (3 *larvae*); Rockport, 169.— KY.: Louisville, 2,294.— IND.: Kokomo, 4,354–4,356 (3 *larvae*); New Albany, 4,686, 4,687 (2 *larvae*).— ILL.: Athens, 2,013 (2); Evanston, 414; Kendall, 2,014; Lawn Ridge, 962 (3); Peoria County, 968; Peoria, 967.— IOWA: Burlington, 152 (3); 4,540; [Davenport, 966].— MICH.: Lansing, 2,072.— [MINN.: Minneapolis, 4,543; 4,544].

With the exception of one of the specimens from Athens, Ill., the preceding are all spotted.

With the exception of a young one (2,043 from Kansas) the following are barred. This is the difference between the forms of races *A. tigrinum* and *A. mavortium.* The Californian specimens (*A. californiense*) have more yellow than most of those from east of the Rocky Mountains.

KANS., 281 (3 *larvae*); 2,043 (2).— DAKOTA, 1,738; 1,739 (2); WY.; Cheyenne 981; 2,217 (3 *adults* and *eggs*); Fort Bridger, 982; 4,528; Lake Como, 1,209 (2); 2,057; Northeastern, 1,682.— COL., 984.— UTAH: Southern, 4,353.— CAL.: Mayfield, 2,344; Palo Alto, 2,343 (5 *larvae*); 2,345; 2,356.

All of the following are axolotls. Some of the Colorado specimens show pigmentation on the belly, differing thereby from the unpigmented belly of normal *A. tigrinum* larvae. The Mexican specimens are *spotted* on the belly.

Col.: Boulder Co., 1,441 (2); Heart Lake, 11,000 ft., 4,748–4,753 (6); Pike's Peak, 280; South Park, 985 (12); 986 (20); 4,530; 4,531.— N. Mex.: Santa Fe, 1,918 (2).— Mex., 2,370; Lake Xochimilco, 2,657; Mexico, 254 (2); 1,654 (5); [1,705 (2)]; 2,357 (3); 2,623; [San Juan Teotihuacan, 2,266 (4)].

41. Ambystoma jeffersonianum (Green).

N. B.: Assikeag, 2,094.— Me.: Eddington, 1,580.— N. H.: Milan, 979.— Mass.: Amherst, 977; Arlington, 2,309 (*larva*); 2,310 (*young*); Berlin, 975; Boston, 978; [Cambridge, 4,545; 4,546]; Concord, 2,886; Sherborn, 972; 2,002; Springfield, 2,096 (2); Ware, 987 (2); Waverley, 1,996 (2); Wenham, 2,093.— N. Y.: St. Lawrence County, Black Lake, 30 May, 1,860 (30 *larvae*); Somerville, 166 (3); 1,201.— Mich.: Flint, 2,092 (2); Oakland County, 1,570 (3); Olivet, 4,362; 4,363.

42. Ambystoma macrodactylum Baird.

Montana: Powell County, Nigger Hill, 6,500 ft., 2,885.

43. Ambystoma cingulatum Cope.

Fla.: Pensacola, 204 (2); 229 (2).

44. Ambystoma microstomum Cope.

Loc. ? 4,360; 4,361.— Mo.: Jefferson County, 2,782 (2).

45. Ambystoma tenebrosum Baird and Girard.

Cal.: Berkeley, 4,364–4,370 (7); Palo Alto, 2,547; near Palo Alto, 2,346.

Plethodontidae.

46. Batrachoseps pacificus (Cope).

Cal.: Santa Cruz Island, 3,169–3,194 (26).

47. Batrachoseps attenuatus (Eschscholtz).

Cal., 1,196 (2); 1,827 (2); 2,109 (3); [4,295–4,297 (3)]; Berkeley, 4,391–4,395 (5); Brookdale, 4,396, 4,397; Claremont, 4,523; 4,524; Filborn, Big Trees, 4,519–4,522 (4); 4,518 (4 *larvae*); Monterey, 2,102; Pacific Grove, 4,373–4,390 (18); Palo Alto, 2,358 (25); 2,548 (13); Petaluma, 1,195 (10); Sacramento, 1,198 (2); San Francisco, 156 (7); 2,282 (2); San José, 1,197 (7); 1,840; 4,605; 4,606; San Mateo, 4,398; San Mateo Creek, 1,194 (12); 2,111 (6); Santa Cruz, 3,349–3,352 (4); Santa Cruz Island, 4,690–4,696 (7).

The specimens from Claremont, although on the edge of the range of *Batrachoseps major* Camp, are in every way typical *B. attenuatus*.

48. Hemidactylium scutatum (Schlegel).

Mass.: Beverly, 2,086; Brookline, 2,639; Lynn, 1,692 (6); Medford, 1,837; Sherborn, 2,003; Springfield, 2,088 (6); Wellesley, 4,399.— N. J.: Plainfield, 2,305.— Pa., 201; Cumberland Valley, 1,444.— S. C., 4,400; Charleston, 1,199.— Texas, 206 (3).

49. Plethodon eschscholtzii (Gray).

Cal., 1,822 (2); 1,999; Brookdale, 4,401–4,408 (8); Filborn, Big Trees, 4,410; 4,411; Pacific Grove, 4,409; Palo Alto, Mountains near, 2,350 (2); Petaluma, 1,208.— Oregon: McMinnville, 4,075.

50. Plethodon glutinosus (Green).

Loc. ? [4,298; 4,299].— Mass., 1,200; [Essex, 4,300; Hamilton, 4,301–4,311 (11)].— N. Y.: Ithaca, 4,412.— N. J.: Plainfield, 2,288 (3); Schooleys Mountain, 158 (3).— W. Va., 990; Petroleum, 991.— Ky., 973; Cumberland Gap, 1,397 (6); Edmonson County, 2,228.— N. C.: Catawba County, 1,382.— S. C.: Charleston, 205; 209; 1,743 (3); Seabrook Island, 993.— Ga., 221 (2); 242; 4,600–4,602 (3); St. Mary's, 2,335 (2); Tallulah Falls, 4,413.— Ala.: Maplesville, 4,414–4,416 (3) Mobile, 4,745.— Mo.: Jefferson County, 3,155; Osage River, 195; (5).— Ark., 178 (2).— Texas: Beaver Cave near San Marcos, 4,541; 4,542.

51. Plethodon metcalfi Brimley.

N. C.: Sunburst, 3,500 ft., 2,888.

52. Plethodon dorsalis (Cope).

Ky.: Bee Spring, 2,222; 4,703; Glasgow Junction, 1,885; Mammoth Cave, 1,681 (27).

Plethodon dorsalis differs from *Plethodon cinereus* in the following characters:—

1. There is usually one less costal groove.

In *P. cinereus* the greatest possible count of costal grooves is twenty. This is obtained by counting as the first one, one immediately over the arm, and as the last, a forked one immediately in front of the leg. If, as sometimes happens, the one over the arm is missing, and the one in front of the leg is not forked, there would be eighteen grooves. Very rarely there is a more real variation, in that one of the middle grooves is lacking. In this case a count of all the grooves would give nineteen and a count omitting the end grooves as before would give seventeen. Now in *P. dorsalis,* counts exactly similar to those given above for *P. cinereus,* give nineteen as the maximum number, which would be seventeen, if, as is usually the case in this form, the one over the arm and the fork of the last groove are both missing; but only rarely does the count rise so high, for in at least half the series the maximum count gives only eighteen and in these specimens a minimum count (and this minimum count is more accurate in *P. dorsalis* than in *P. cinereus*) gives only sixteen. To sum up, if we omit one groove sometimes present over the arm (much more frequently in *P. cinereus*) and do not as a separate groove a fork of the one just in front of the leg (and this also is more frequent in *P. cinereus*), the costal grooves of *P. cinereus* are eighteen, rarely seventeen, and those of *P. dorsalis* are indifferently seventeen or sixteen.

2. The tail of *P. cinereus* is longer than that of *P. dorsalis.* In *P. dorsalis* the tail is never as long as the head and body, while in *P. cinereus* it is often longer.

3. The dorsal band or strip is in all but one of this series markedly zigzag, so that the stripe resembles that of *Desmognathus ochrophaca carolinensis.* In one of the series the stripe is straight edged, but much narrower than that of *P. cinereus* of equal size. This specimen has a head-and-body length of 40 mm. The stripe is between 1 and 2 mm. wide. In *P. cinereus* of the same size from Massachusetts the stripe is over 3 mm. wide.

Like *P. cinereus* this form has a melanistic phase. It is, however, much rarer and seems to be a gradual darkening with age rather than a true melanistic variety. Four of the thirty specimens in the col-

lection are dark and the stripes cannot be distinguished. These are all large, in fact the four largest. The stripe is straight edged on the tail.

4. There is a light vertical line rising from the lip between the nostrils. On reaching the top of the head it forks and passes backwards along the canthus rostralis to the eye. The vertical line is never present in *P. cinereus* and the line along the canthus is very faint.

These are sufficient to show a form different from our common eastern *Plethodon cinereus*. Its status, however, is not easy to fix. Cope, in describing it from Louisville, Ky., mentions one which he found "in a bottle with common varieties of the *P. erythronotus*, the *Spelerpes bilineatus*, and *Desmognathus*, all from Essex County, Mass." These were in the Museum of the Essex Institute.

I think that this record can be disregarded for the present. In 1892 Cope recorded *Plethodon cinereus dorsalis* from Franklin, Venango Co., Pa. Possibly this was the recently described *P. wehrlei*, but it may have been *P. dorsalis*, which occurs in Ohio. He also mentions one U. S. N. M. 3,825 from Ripley, Ohio, which had sixteen costal grooves and the proportions of *P. dorsalis*. He, however, calls it *P. cinereus*, as it was melanistic. Now *P. cinereus* never has as few as sixteen costal grooves, and as *P. dorsalis* has also a dark phase, there is no reason why this specimen is not *P. dorsalis*. Cope states that in *P. dorsalis* the distance from snout to armpit is contained only three times in that from snout to groin, instead of $3\frac{1}{8}$ or $3\frac{1}{2}$, as in *P. cinereus*. As a matter of fact it is three in both.

O. P. Hay in his Batrachians and reptiles of Indiana in 1891 records *P. dorsalis* from Wyandotte Cave, near Louisville, Ky., and at Bloomington, Ind.

In 1907 McAtee, (List of the mammals, reptiles and batrachians of Monroe County, Indiana. Proc Biol. soc. Washington,) records *P. cinereus*, *P. dorsalis*, and *P. erythronotus* and states that *P. dorsalis* is rare.

He states that *P. erythronotus* is found in comparatively dry places and that the other two are found near water. This may be significant when we consider that there is a distinct possibility that McAtee's *P. cinereus* may have been the dark phase of *P. dorsalis*.

The same applies to Hahn's statement in The fauna of Mayfield's Cave. Publication 67, Carnegie inst., 1907. Mayfield's Cave is in Monroe Co., Ind. Hahn records two *P. cinereus* and one *P. dorsalis* taken in the Cave.

Hahn, in a second paper, in 1908, (Notes on the mammals and cold-blooded vertebrates of the Indiana University Farm, Mitchell, Indiana,) states that "None were noted, however, of the so-called *erythronotus* variety with the red of the back bordered by parallel lines, but the *dorsalis* variety with an irregular line of red along the back was almost as common as the ashy-colored individuals . . . these have the sides and dorsum of the tail mottled with gray and brown, caused by the segregation of the gray specks into certain areas." This does not accord with the dark phase of *P. cinereus* as it is met with in the east.

These are all the records I have been able to find of this salamander. It apparently is restricted to a region including western Pennsylvania and southwestern Ohio, southern Indiana, and central Kentucky.

True *P. cinereus* is not known from Kentucky as yet. It is found in Ohio, Indiana, Illinois, Missouri, and Arkansas, to the north and west and in eastern Tennessee to the southeast.

It apparently occurs with *P. dorsalis* in Ohio and Indiana. I think it more in accord with our knowledge of the two forms at present to regard *P. dorsalis* as a distinct species.

53. Plethodon cinereus (Green).

N. B.: St. John's, 1,236; 4,661; St. John's, Lily Lake, 1,187 (23)— Me.: Rangeley, 2,106; Treat Island, 1,174 (2); 1,178 (2); Waterville, 2,104.— N. H.: Amherst, 1,189; Exeter, 1,191 (8); Milan, 1,190; 4,736; White Mountains, Glen House, 1,169.— Mass.: Bedford, 1,179; Berlin, 1,170 (3); Beverly, 4,726–4,730 (5); Boston, 1,819; Cambridge, 4,427–4,438 (12); Cape Cod, 1,181 (7); Cohasset, 3,527; Feltonville, 1,177 (2); Gloucester, 1,386; Hudson, 1,180 (2); Lynn, 1,691 (5); Malden, 1,430; Mattapan, 1,851; Medford, 1,183; Mount Tom, 1,184 (3); Newton, 1,910 (12); 2,300 (3); Sherborn, 2,004 (2); Springfield, 2,067 (19); 4,533–4,539 (7); 4,611–4,613 (3); Tuckernuck Island, 2,286; Ware, 1,172; Warwick, 1,182 (6); Westboro, 4,417–4,426 (10); West Roxbury, 1,185; 1,821 (5); Williamstown, 1,175; Windham, 2,068 (9); Woburn, 1,186.— N. Y.: Berkshire, 176; 228; 239 (2); Fallsburg, 1,176 (4); Ithaca, 3,156; 3,157 (2); 3,159–3,162 (4); 3,164–3,168 (5); 4,659; 4,660; Somerville, 164 (14); 165 (5); 187 (18); 191 (2); 1,188.— N. J.: Plainfield, 2,304 (2); Schooleys Mountain, 162 (3).— Pa.: Norristown, 1,413; 1,414 (2).— Va.: Bailey's Cross-roads, 4,763, 4,764 (2); [Norfolk, 4,725]; Strasburg, 2,031 (4).— Ga., 154; 241; Dallas County, 1,834 (2).— Ill.: 1,828 (4).— Mich.: Flint, 2,113 (2); Marquette County, 2,110 (2).

54. ANEIDES LUGUBRIS (Hallowell).

Loc. ? 4,287–4,289 (3).— CAL., 216; 1,842; 2,076 (4); [4,284–4,286 (3); 4,290–4,294 (5)]; Brookdale, 4,449–4,452 (4); Carmel, 2,544 (2); Pacific Grove, 4,439–4,448 (10); Palo Alto, 2,347; 2,351 (7); 2,549 (5); Petaluma, 1,204 (4); 4,689; San Francisco, 192 (5); San José, 1,046; 1,047 (5); 1,749 (2); San Mateo, 2,066; Santa Barbara, 4,453–4,460 (8).

55. ANEIDES IECANUS (Cope).

CAL.: Los Gatos, 2,545; Stevens Creek Cañon, 2,348 (2).

This species is not so large as *P. lugubris* and is uniform black.

56. DESMOGNATHUS QUADRAMACULATA (Holbrook).

N. C.: Blantyre, 2,638.— S. C.: Charleston, 183.

57. DESMOGNATHUS MONTICOLA Dunn.

W. VA.: Petroleum, 1,163.— KY.: Breathitt County, 1,708; Edmonson County, 2,230.— N. C.: Blantyre, 2,546.— GA., 200 (5); 215 (3).

The West Virginia and Kentucky records extend the known range of this form considerably. It is not surprising to find *D. monticola* in the Alleghanies in Ritchie Co., W. Va., and Breathitt Co., Ky., but the Edmonson Co., Ky., record is so surprising that one is inclined to doubt whether there may not be some error.

58. DESMOGNATHUS FUSCA FUSCA (Rafinesque).

SASKATCHEWAN: Cedar Lake, 1,572.— ME.: Norway, 1,569 (2); Rangeley, 2,082 (8).— N. H.: Amherst, 1,165; 1,167 (2); Blair, 4,583; North Conway, 1,166 (3).— VT.: Burlington, 1,160.— MASS.: Springfield, 1,990; 2,087 — [Conn.: New Haven, 4,470].— N. Y.: Berkshire, 174; 231; 1,157; 1,161 (3); 4,584–4,590 (7); Ithaca, 4,467; 4,468; Ovid, 1,158; Tupper Lake, 4,461; Utica, 4,462–4,466 (5).— N. J.: Plainfield, 2,306 (10); Ridgewood, 2,409 (2); 2410.— PA.: Center County, 1,164; Sunbury, 1,159.— VA.: Bailey's Cross Roads, 2,095 (2); Danville, 1,839 (2); Lynchburg-Otter Peaks, 1,429.— ILL.: Normal, 2,054; 2,056 (2).— KY.: 2,085 (6); 4,743; 4,744; Bee Spring, 1,466; Cumberland Gap, 2,223; 4,667; 4,668; Dismal Creek, 4,469; Edmonson County, 2,229.— TENN.: Knoxville, 222.— N. C.: Catawba County, 1,383; [Raleigh, 4,723].— GA., 155 (12); 163 (8); 4,569; 4,570.

The Cedar Lake record is a most remarkable one. It lends credence to Nash's record for Ontario. It is of course an instance of postglacial spreading, and indicates that *D. fusca* in times directly after the glaciation extended much further west. The isolation of *D. brimleyorum* in Arkansas and the fragmentary range of *D. fusca* in Indiana and Illinois led me to this belief when writing my revision of the genus, though at the time I did not expect so startling a corroboration.

59. Desmognathus fusca auriculata (Holbrook).

N. C.: Beaufort, 1,168 (9); 4,657; 4,658; New Berne, 1,884.— Fla.: Jacksonville, 1,070 (3).— Ala.: Mobile, 2,783; 4,746; 4,747.

60. Desmognathus brimleyorum Stejneger.

Ark.: Hot Springs, 2,598 (2 *paratypes*); 2,537; 2,784 (2); Little Rock, 3,142; 4,547–4,550 (4).

61. Desmognathus ochrophaea ochrophaea Cope.

Loc. ? 4,471–4,474 (4).— N. Y.: Berkshire, 4,591–4,593 (3); Ithaca, 3,158; 3,163; 4,525–4,527 (3).— Pa.: Gold, 4,475–4,480 (6).

62. Desmognathus ochrophaea carolinensis Dunn.

N. C.: Black Mountains, 1,162 (3); Blantyre, 2,631; Macon County, Bald Mountain, 2,543; Saluda, 4,481.— Tenn.: Unaka Springs, 4,482.— Ga., 212; 4,594–4,599 (6).

63. Stereochilus marginatus (Hallowell).

N. C.: Lake Ellis, 2,541; New Berne, 4,742.

New Berne is the most northerly, and I believe the third recorded locality for this rare species.

64. Typhlotriton spelaeus Stejneger.

Mo.: Stone County, 3,141; Stone County, Marble Cave, 2,781 (2); 2,873–2,880 (8); Stone County, Reed's Spring, 3,485 (*larva*); Wright County, Davis Cave, 2,554 (2 *larvae*).

This species seems closest of all to the free-tongued species of the Plethodontidae. The tongue is a great deal freer than in any other

of the attached-tongued species and the larva has only three epibranchials instead of the four found in Desmognathus. Furthermore the great resemblance of the larva to that of *Pseudotriton ruber* and the angle in the vomerine tooth-row ally it to that species although the prefrontal bone is of the usual type and does not reach the nares.

65. Typhlomolge rathbuni, Stejneger.

Tex.: San Marcos, 2,428; 4,170; 4,171; San Marcos, Frank Johnson's well, 4,653; 4,654.

The latter is a recently discovered place of capture and is worth noting as the species is no longer taken at the old well where it was first caught.

I cannot agree to the assignment of this animal to the Proteida where it is placed in the recent Check list of Stejneger and Barbour. It agrees, as Miss Emerson has shown, in practically every point in its anatomy with the larvae of Pseudotriton and of Typhlotriton. If the classification is to show the relationships I do not see how this species can possibly be placed anywhere than among the Plethodontidae as a permanent larva. In the absence of lungs, the fusion of the otic bones, the absence of any ypsiloid apparatus, even in such characters as the fusion of the premaxillaries and the number of epibranchials, it agrees with the larvae of the two genera of Plethodontidae mentioned. Indeed, every reason that can be assigned for placing Typhlomolge in the Proteida applies also to the axolotl.

66. Gyrinophilus danielsi (Blatchley).

N. C.: Haywood County, 2,890.

67. Gyrinophilus porphyriticus (Green).

Ontario, 1,370 (3).— N. H.: White Mountains, 996.— Mass.: Princeton, 2,296; Williamstown, 4,483–4,488 (6).— N. Y.: Adirondack Mountains, McBride's Pond, 3,976; Berkshire, 198 (5); 1,240; 4,577–4,582 (6); Elizabethtown, 2,279; Tupper Lake, 994; 4,274.— N. J.: Plainfield, 4,489 (*larva*).

68. Geotriton fuscus (Laurenti).

Italy: Genoa, 1,944.—Sardinia, 2,166.

Inasmuch as this species has not only separate premaxillaries, but lacks the prefrontal bones, I can see no reason why it should be included in Eurycea (Spelerpes *auct.*). It deserves generic rank more than does Gyrinophilus, which is usually accorded that rank.

69. Pseudotriton montanus Baird.

N. C.: Beaufort, 997.— Tenn.: Knoxville, 224 (2).

At the base of the free-tongued salamanders should come those which have two premaxillaries, as Gyrinophilus and Geotriton. These two genera differ from each other in that Gyrinophilus has large prefrontals which form part of the border of the nasal opening, while Geotriton lacks these bones altogether.

Pseudotriton has the prefrontals cut off from the nasal opening, but the premaxillaries are co-ossified.

Eurycea has the prefrontals cut off from the nasal opening. Its premaxillaries are co-ossified.

Minor characters allying Pseudotriton to Gyrinophilus are seen in the habitus, the dentition, the color, and the larvae, which differ from those of Eurycea. Only one species of Eurycea, *E. lucifuga*, approaches the species of Pseudotriton in color.

70. Pseudotriton ruber ruber (Sonnini).

N. J.: Plainfield, 2,302 (2); Ridgewood, 2,408; Schooleys Mountain, 159 (3).— Pa.: Norristown, 170 (7); 1,412.— Ky., 4,760–4,762 (3 *larvae*); Bee Spring, 2,220; 4,558–4,561 (4); 4,738–4,741 (4 *larvae*); Castor County, 1,243 (*larva*); Cumberland Gap, 4,664–4,666 (3 *larvae*); Edmonson County, 999; Mammoth Cave, 1,680 (6).— Tenn.: Knoxville, 223.— N. C.: Catawba County, 1,381; Old Fort, 998.— Ga., 193 (5); 210 (5); 217 (2); 4,532; 4,562–4,568 (7 *larvae*); Milledgeville, 185 (2).

One of the specimens from Edmonson County is very extraordinary. The tail is regenerated and hence has not a normal appearance. Otherwise the proportions are those of *P. ruber ruber*. The coloration is almost that of *P. montanus* but lacks the ground color. The palatine teeth are quite closely approximated in front, but in a small specimen this may not be of great significance.

In the larger of the two specimens from Milledgeville the vomerine teeth are not continuous with the parasphenoid series.

71. Pseudotriton ruber schencki (Brimley).

N. C.: Sunburst, 2,889.— Ga.: Tallulah Falls, 4,490; 4,491.

This form of the higher southern Alleghanies intergrades with *P. ruber ruber* both to the north and to the south.

Specimens from Catawba Co., N. C., (1,381), and from Georgia, (217), show how this is effected. The chief differences between *P. ruber ruber* and *P. ruber schencki* are those of color. Briefly in the former the black spots run together in the adult and the chin is not black-white; in the latter the spots do not run together and the chin is black.

The intergrades to the east and north of Asheville, N. C., have the clear coloration but lack the black chin. The intergrades to the south have the black chin but the coloration is clouded.

72. Eurycea lucifuga Rafinesque.

Ind.: White River, 4,276.— Ky.: Baker's Furnace, 1,110 (6); Bee Spring, 4,557 (*larva*); Diamond Cave near Glasgow Junction, 1,465; Dismal Creek near Bee Spring, 4,496 (*larva*); Edmonson County, Haunted Cave, 1,464; 1,679 (2); Lexington, 2,271 (3 *larvae*).— Mo.: Jasper County, Wilson's Cave, 2,269 (22 *larvae*); 2,270 (*larva*); 4,607, 4,608 (2 *larvae*); Jefferson County, 2,778 (2); 3,147; Stone County, 2,540; Stone County, Marble Cave, 2,550.— Ala., 225 (*larva*).

Larvae of Eurycea are distinguished from those of Pseudotriton and Gyrinophilus, which also have dark gills, by being noticeably lighter on the dorsal surface than on the sides. They fall into three groups, groups which are also evident in the relationships of the adults. These are;— 1st *E. lucifuga;* 2d *E. longicauda, guttolineata,* and *melanopleura* (*stejnegeri auct.*); 3d *E. bislineata* and *multiplicata.*

Larvae of *E. lucifuga* show a resemblance to larvae of Pseudotriton in that there is not so sharp a demarcation between the back and sides. The upper series of larval areas are not so large as in the other species and the back becomes light by gradual loss of pigment instead of an enlargement of the areas.

The lateral and lower series are not conspicuous, but the lower series is present. The most noticeable feature of *E. lucifuga* larvae is a wide grayish stripe between the lateral and lower series of larval areas.

Larvae of *E. guttolineata* are distinct, owing to the prominence of the

lower series which forms a stripe along the sides of the belly, and to the almost immaculate dorsal surface of the larvae which is sharply marked off from the almost black sides. Larvae of *E. longicauda* and *E. melanopleura* show the same features but owing to their generally having less pigment the lower row of areas is not conspicuous.

Larvae of *E. bislineata* and *E. multiplicata* have the lower row of areas lacking and the upper row is very large and pigment accumulates as a broken band between the areas of each upper row so that there is a broken dorsolateral stripe. Larvae of *E. multiplicata* have a much slimmer form, owing to the greater number of costal grooves.

The following key gives a summary of the above.

1. No sharp demarcation between the lighter back and the darker sides, 13 costal grooves.
   Lower row present, gray band on sides..... *lucifuga.*
2. A sharp and uninterrupted demarcation between the lighter back and the darker sides, lower row present, 13 costal grooves. Sides black.
   A. Lower row a definite stripe..... *guttolineata.*
   B. Lower row not a definite stripe
   longicauda and *melanopleura.*
3. A sharp but broken demarcation between the lighter back and the darker sides, lower row absent, more than 13 costal grooves.
   bislineata and *multiplicata.*

As far as known no two species of any one of these three groups occur together. This renders identification simpler and surer.

73. Eurycea guttolineata (Holbrook).

Loc. ? 4,494, 4,495 (2 *larvae*).— N. C.: Andrews, 2,539; Gaston County, 1,303. — Ga.: Augusta, 235.— Ala.: Mobile County, 2,777 (2); 3,150.— Miss.: Water Valley, 4,493.— La.: New Orleans, 2,100; Port Hudson, 1,109.

74. Eurycea longicauda (Green).

Va.: Hot Springs, 4,492.— W. Va.: Petroleum Lake, 1,108.— Ohio, [4,275]; Yellow Springs, 1,112 (13); 1,886.— Ky.: Bee Spring, 995 (*larva*); Cumberland Gap, 2,225 (12); Edmonson County, 1,107; 2,227 (2); Mammoth Cave, 1,111; 2,226.— Mo.: Jefferson County, 2,779 (3); 3,149; St. Louis, 2,301.— Ga., 218 (3).

The specimens from Georgia are very close to *E. guttolineata*. They differ from typical *E. longicauda*:— 1st, in having the median line of the tail unspotted, 2d, the bars on the tail are fused dorsally and 3rd, there is a single, somewhat run together, line of spots in the middle of the back instead of a generally spotted back. The physiognomy is that of *E. guttolineata*.

The only real differences between them and *E. guttolineata* are that the belly is unpigmented, the middorsal stripe is somewhat broken up, and there are distinct evidences of bars on the tail. As these specimens are without definite locality, I do not make *E. guttolineata* a subspecies, but there can be no doubt that they intergrade, and that this intergradation takes place in Georgia. It is gratifying that my prediction as to the close relationship of these two forms is demonstrated.

75. Eurycea melanopleura (Cope).

Mo.: Jasper County, Wilson's Cave, 2,551 (paratype of *E.* (*Spelerpes stejnegeri* Eigenmann); 4,609; 4,610; Stone County, 2,538; 2,780 (2); 3,776; 3,777; Stone County, Reed's Spring, 3,486.— Tex., 244.

This species is very close to *E. longicauda*, differing from it in the indistinctness of the bars on the tail, and in the arrangement of the pigment on the back so as to leave the median line unspotted. Traces of this arrangement are sometimes found in young *E. guttolineata* where the dorsal stripe is divided in the middle.

Comparison of all available material of this species including the type, with similar material of the so-called *Spelerpes stejnegeri* Eigenmann, makes it perfectly plain that the former is the young of the latter. Cope's name has years of priority over Eigenmann's.

Hurter in various publications records this species, under Eigenmann's name, and as *E. longicauda* from different localities throughout Missouri. He records them in a way that indicates an overlapping distribution. However, as these two species are very closely related and as Hurter was collecting before *E. stejnegeri* was described, and as neither this collection, nor the National Museum, which includes Hurter's own collection, has the two from the same place or from places which would mean overlapping of ranges, it is probably safe to regard them as vicarious species. Specimens of *E. longicauda* are in collections from two counties, St. Louis and Jefferson. Franklin county is the farthest east for *E. melanopleura*.

76. Eurycea multiplicata (Cope).

Ark.: Pulaski County, 2,883; 2,884.

77. Eurycea bislineata (Green).

Canada: St. Lawrence, 240.— Me.: Paris Hill, 315 (7); Rangeley, 2,103 (4); 2,112 (2).— N. H.: Amherst, 1,193; North Conway, 4,733–4,735 (3); Shelburne, 1,945.— Vt.: Woodstock, 4,507–4,511 (5).— Mass.: Auburndale, 1,235; Boston, 4,662; 4,663; Leominster, 211; Medford, 1,841 (4); North Wrentham, 1,829; Rowe, 175 (20 *larvae*); Waltham, 233; Watertown, 4,512–4,516 (5); Wenham, 1,202 (4).— Conn.: New Haven, 4,497–4,506 (10).— N. Y.: Berkshire, 232; 236 (2); 238; 1,114; 1,116; 1,909 (7); 4,571–4,576 (6); Ithaca, 3,148. — N. J.: Plainfield, 2,307 (9); Ridgewood, 2,407; Schooleys Mountain, 1,914 (2).— Va.: Lynchburg-Otter Peaks, 4,737.— Ohio: Yellow Springs, 1,192 (2).—Ind.: Wabash, 2,552.— Ky.: Bee Spring, 4,701, 4702 (2 *larvae*).— N. C.: Mitchell's Peak, 1,115; [Raleigh, 4,722].— S. C.: Charleston, 227.— Ga., 234; 1,913.— Fla.: Camp Barranca, 1,375; 4,552–4,556 (5).— Ala.: Maplesville, 4,517.— La.: New Orleans, 2,098 (2).

The ally of this species is *E. multiplicata*. The two represent a wave of dispersal which has reached New Brunswick to the northeast and New Mexico to the southwest.

78. Manculus quadridigitatus (Holbrook).

N. C.: Raleigh, 4,076–4,078 (3).— Fla.: Camp Barranca, 1,378; Gulfport, 3,575.

This species is closely allied to the species of Eurycea, especially to the group of *E. guttolineata*. The larva, which resembles exceedingly the larva of that species, has the lower row of areas a stripe, but of course the four toes distinguish it at once.

79. Oedipus leprosus (Cope).

Mexico: Hidalgo, Guerrero, 3,912–3,930 (19).

I use Oedipus provisionally for the salamanders allied to *leprosus*, *bellii*, *variegatus*, etc. These do not seem to be particularly close to he species of Eurycea or Pseudotriton. Still less are they allied to the European *Geotriton fuscus*.

80. Oedipus bellii (Gray).

Mexico: Hidalgo, Guerrero, 3,931–3,949 (19); San Miguel, 3,956.

81. Oedipus adspersus Peters.

Colombia: San Lorenzo, 3,894; 3,895.— Venezuela: Culeta near Merida, 2,605.

82. Oedipus variegatus (Gray).

Mex.: Southern, 2,314.

83. Oedipus yucatanicus Peters.

Yucatan: Chichen Itza, 2,431; 2,773 (3).

84. Oedipina uniformis Keferstein.

Costa Rica: Cartago, 2,821.

Sirenidae.

85. Siren lacertina Linné.

Loc. ? [4,278 — Southeastern U. S., 4,277].— S. C.: Charleston, 1,445; 1,446; Georgetown, 140.— [Ga.: Athens, 255].— Ala.: Mobile, 149.— La.: New Orleans, 250.— Ill., 941 (3).

86. Pseudobranchus striatus (Leconte).

S. C.: 961 (7); Charleston, 2,083.— Ga., 147 (6).